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(54) Title: PASSENGER DETECTOR (54) Titre: DETECTEUR DE PASSAGER (57) Abstract <p>The invention concerns a passenger detector comprising a flexible support made of insulating material, at least two electrode structures arranged on said insulating substrate at some distance from each other, and a layer made of a semiconductor material arranged above said electrode structures in an active zone of the detector. The invention is characterised in that said semiconductor material layer has an internal resistance variable with the deformation of said layer and said semiconductor material layer is arranged in close contact with said electrode structures.</p> <p>(57) Abrégé <p>On présente un détecteur de passager comprenant un support flexible en matière isolante, au moins deux structures d'électrodes disposées sur ledit substrat isolant à une certaine distance l'une de l'autre, et une couche en matière semi-conductrice disposée au dessus desdites structures d'électrodes dans une zone active du détecteur. Conformément à l'invention, ladite couche en matière semi-conductrice présente une résistance interne variant avec une déformation de ladite couche et ladite couche en matière semi-conductrice est disposée en contact intime avec lesdites structures d'électrodes.</p></p>			
<p>NOT PRIOR ART</p>			

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### **Passenger detector**

5       The present invention relates to a passenger detector, which is used to detect the presence of a passenger on the seat of a vehicle and/or said passenger's position on said seat. Such a detector has a particular application in controlling a motor vehicle protection system such as airbags.

10       In order to protect the life of passengers during a traffic accident, modern vehicles are generally fitted with a protection system comprising several airbags and seat belt pretensioners, which are used to absorb the energy of a passenger released during the collision due to the accident. In order to deploy the airbags of the passenger seat only in the case where this seat is actually occupied by a person, passenger detectors have been developed that indicate  
15       the presence of a passenger to the control unit of the protection system.

      Such a detector is described, for example, in the document DE-A-42 37 072. It concerns a pressure detector integrated into the passenger seat, which comprises two insulating substrates placed one above the other and  
20       separated by a certain distance using a separator. The separator comprises, for example, a two-sided adhesive band which is cut in such a way as to surround at least in part the active zones of the detector. Inside the active zones, one of the supporting sheets is provided with two electrode structures made of a conducting material separated from each other, while the other supporting sheet  
25       is provided with a coating of a pressure-sensitive semiconducting or resistive material. The semiconducting or resistive material has microprojections on the surface so that the surface resistance between the layer and a conductor decreases when the layer is pressed on to the conductor.

30       When the passenger seat is unoccupied, i.e. when no pressure is acting on the passenger detector, the layer of semiconducting material is not in contact

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with the two electrodes and the electrical resistance between the two electrodes is consequently very high. If, on the contrary, a person is sitting on the seat, the two supporting sheets are pressed together and the pressure-sensitive layer is put into contact with the two electrodes. This produces, between the two electrodes, a short circuit whose electrical resistance varies inversely with the value of the applied pressure. The greater the pressure on the sensor, the more the semiconducting layer is compressed or the more it comes into intimate contact with the electrodes, and the more the resistance measured between the two electrodes decreases.

One disadvantage of such a detector lies in its high rigidity. In effect, due to the lamination of the two supporting sheets using an adhesive band, the detector is quite thick and has a high resistance to bending or twisting, which significantly reduces its flexibility. Consequently, the introduction of such a detector in the seat of a vehicle may have a detrimental effect on the comfort of the seat.

The objective of the present invention is to propose a passenger detector that does not have this disadvantage.

This objective is attained by a passenger detector comprising a flexible support of an insulating material, at least two electrode structures placed on said insulating substrate at a certain distance from each other, and a layer of semiconducting material placed above said electrode structures in an active zone of the detector. In conformity with the invention, said layer of semiconducting material has an internal resistance that varies with a deformation of said layer, and said layer of semiconducting material is placed in intimate contact with said electrode structures.

It should be noted that the internal resistance of the semiconducting layer may vary not only with a compression of the layer but also with a bending or

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any other deformation of the layer. Moreover, the internal resistance of the layer may vary in the same sense as the deformation (e.g. the resistance increases when the pressure increases) or in the opposite sense of the deformation (e.g. the resistance decreases when the pressure increases).

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The detector according to the present invention therefore has only one supporting sheet, on to which are deposited both the electrode structures and the layer of semiconducting material. The rigidity conferred by the lamination of several layers no longer applies to the detector according to the present invention. Moreover, the passenger detector is not as thick as conventional detectors. Consequently, such a sensor causes much less discomfort when it is integrated into the seat of a vehicle and it therefore responds better to the demands of said seat as regards comfort.

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Moreover, manufacturing the detector according to the present invention may cost less than producing conventional detectors. In effect, the use of only a single supporting sheet reduces the consumption of supporting sheet by half. In addition, there is no longer any need for a separator in the form of a two-sided adhesive band.

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In conventional detectors, the supporting sheets and the separator enclosed a space between them, which had to be connected to the environment using ventilation channels in order to allow an exchange of pressure. However, these ventilation channels made the sensors sensitive to humidity, which re-  
entered the detector together with the air from the environment. In the detector according to the invention, the ventilation channels are no longer necessary and the present detector forms a sensor that is closed and sealed, into which humidity can no longer enter.

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Another advantage of the passenger detector described above is its lower susceptibility to production tolerances. In conventional detectors, the

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precision with which the two supporting sheets are positioned with respect to each other is a crucial factor in the assembly of the detector. A slight offset between the two sheets would lead to insufficient coverage of the semiconducting layer and hence to the production of a detector that does not  
5 comply with specifications. In the new detector, all the layers are deposited, printed or stuck on the same supporting sheet, which facilitates the positioning of the various layers with respect to each other ("matching") and therefore leads to sensors with very low production tolerances. The production of sensors not complying with specifications is consequently significantly reduced, which  
10 increases the productivity of the production line.

In order to increase still further the flexibility of the passenger detector, said flexible support preferably comprises a woven or non-woven fabric. This may be a cloth, a knitted cloth or one that is non-woven and made of insulating  
15 synthetic fibres. Such a support has a very great flexibility in three dimensions and hence adapts very well to the three-dimensional surface of the seat. Moreover, such a fabric may be very thin and, in spite of that, may have a very high resistance to mechanical stress. Any destruction of the support due to fatigue is therefore ruled out.  
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Another advantage of a fabric is its very high permeability to air and humidity. As a result, such a passenger detector does not form a barrier to humidity in the vehicle seat and hence completely satisfies all the requirements of said seat as regards comfort.  
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Said electrode structures are, for example, deposited or printed on the support of insulating material. Alternatively, said electrode structures are engraved or etched into a metallic layer deposited on said insulating support. The deposition or printing, or the engraving or etching, of the electrode  
30 structures is advantageously carried out simultaneously with the deposition, printing, engraving or etching of conductors for heating the seat.

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In a first advantageous execution, said layer of semiconducting material comprises a semiconducting ink that is printed on said electrode structures. The printing is carried out, for example, by the screen-printing process or according to the inkjet method.

In an alternative execution, said layer of semiconducting material comprises a conducting elastomer, granulated or non-granulated, which is deposited or stuck on to said electrode structures. Such a layer of semiconducting material has a better flexibility than layers of semiconducting ink.

It should be noted that the layer of semiconducting material is preferably divided into several zones, positioned at different places above said electrode structures and thus defining several active zones of said detector.

In order to protect the detector from corrosion, the detector preferably comprises a protective layer applied on to said electrode structures and said layer or layers of semiconducting material. Said protective layer may be, for example, a layer of an inert lacquer that is applied by simple immersion of the sensor in the lacquer.

Because of its very great flexibility and its small thickness, the detector according to the present invention is very suitable for integration into a vehicle seat. Moreover, by virtue of these very advantageous characteristics, the present detector is compatible with many more seats than conventional detectors. In addition, the present detector is suitable for many more applications than a conventional detector.

In effect, a detector as described above may be integrated not only into the surface of the seat in order to detect the presence and/or the weight of any

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possible passenger, but also into the back of the seat and/or into the head-rest. When integrated into these places, the detector functions as a detector of position and may detect whether the passenger is resting against the back or the head-rest or whether the passenger is leaning forward. In the latter case, the functioning of the airbag system may, as a result, be modified. Similarly, such a detector may be easily integrated into the pads at the side of the seat in order to detect the lateral position of the passenger on said seat.

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Apart from its applications in the seat, the passenger detector as described above may be integrated into the floor carpet in the body of the vehicle in order to detect whether or not the passenger's feet rest on the floor. Integrated into the seat belt, the detector may detect the passenger's position, since the seat-belt's inertia wheel system exerts a greater tension on the belt as it is increasingly unwound.

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**Claims**

1. Passenger detector comprising a flexible support made of an insulating material, at least two electrode structures placed on said insulating substrate at a certain distance from each other, and a layer of semiconducting material placed above said electrode structures in an active zone of the detector, characterised in that said layer of semiconducting material has an internal resistance that varies with a deformation of said layer and in that said layer of semiconducting material is placed in intimate contact with said electrode structures.
2. Detector according to Claim 1, characterised in that said flexible support comprises a woven or non-woven fabric.
3. Detector according to one of Claims 1 or 2, characterised in that said electrode structures are deposited or printed on the support of insulating material.
4. Detector according to one of Claims 1 or 2, characterised in that said electrode structures are engraved or etched in a metallic layer deposited on said support of insulating material.
5. Detector according to one of Claims 1 to 4, characterised in that said layer of semiconducting material comprises a semiconducting ink which is printed on said electrode structures.
6. Detector according to one of Claims 1 to 4, characterised in that said layer of semiconducting material comprises a conducting lastomer, granulated or non-granulated, which is deposited or stuck on said electrode structures.



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- 5      7.      Detector according to one of Claims 1 to 6, characterised in that the layer of semiconducting material is divided into several zones positioned at different places above said electrode structures, thus defining several active zones of said detector.
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- 10      ~~8.      Detector according to one of Claims 1 to 7, characterised by a protective layer applied on to said electrode structures and said layer or layers of semiconducting material.~~
9.      Vehicle seat comprising one or more passenger detectors according to one of Claims 1 to 8.
- 15      10.      Vehicle seat according to Claim 9, characterised in that a passenger detector according to one of Claims 1 to 8 is integrated into the surface of the seat and/or into the back and/or into the head-rest.
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